

Application No. 10/784,055
After Final Office Action of August 18, 2009

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Docket No.: REB-13602/01

REMARKS

Applicant notes with appreciation the detail and thoroughness of the examination embodied in Paper No. 20090816. The following remarks are fully responsive thereto.

Currently all pending claims stand rejected under 35 U.S.C. §103(a) over Towler et al. (US 6,409,974) in view of Holland et al. (US 6,572,837).

In addition claim 28 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Towler et al. in view of Holland et al. and further in view of Thompson (US 5,281,253).

Reconsideration and withdrawal of all rejections is respectfully requested on the basis that none of the cited prior art alone or in combination teach or suggest all elements of the pending claims, and further, the cited prior art teach away from the claimed process.

The basis of the rejection is that Towler teaches all limitations of pending independent claim 16 with the exception that "Towler fails to teach that hydrogen is passed through a membrane to thereby separate the hydrogen from the raffinate stream after the water gas shift reaction." (Paper No. 20090816, page 5, last paragraph.) To bolster the deficiencies in Towler, the outstanding Office Action cites Holland as teaching

a method for producing hydrogen (col. 1) wherein two reactions proceed, the first being a reforming reaction and the second being a water gas shift reaction, whereby the product stream of the water gas shift reaction is purified by passing the hydrogen through a hydrogen permeable membrane and leaving the raffinate (col. 4, lines 15-26; col. 7, lines 46-61). (Paper No. 20090816, page 6.)

In sum, the outstanding Office Action asserts that the claimed process is taught by the combination of Towler and Holland because Towler teaches reforming and shift reactions and Holland teaches purification of hydrogen by passing the product of a reforming reaction through a hydrogen permeable membrane.

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The outstanding rejection fails to satisfy a *prima facie* case of obviousness because all elements of the claimed process are neither taught nor suggested by the combination of Towler and Holland. To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981 (CCPA 1974). Specifically, neither Towler nor Holland teach or suggest transferring hydrogen and an endothermic reaction product to a secondary stage membrane reactor thereby collecting purified hydrogen as per claim 16. The outstanding Office Action cites with particularity column 7, lines 46-61, and associated Figure 2 as teaching purification of a hydrogen stream relevant to the second reactor stage of subject claim 16. Analysis of both Figure 2 and this section of column 7 reveals that the claimed process of Holland involves:

1. A fuel processing reaction such as a reforming reaction that occurs within a primary fuel processing reactor 204;
2. The product from the primary fuel processing reactor fed to a first hydrogen separating device 206 wherein no chemical reaction occurs. Instead, the products of the first reformation reaction are merely separated into a substantially pure hydrogen stream and a retentate stream.
3. The retentate stream is then fed to a secondary reformer whereby a second chemical reaction occurs to liberate more hydrogen; and
4. A secondary hydrogen separator similar to the first wherein no chemical reaction occurs separating substantially pure hydrogen for transfer to a storage device.

In sum, the Holland process repeats a separate reformation reaction and a hydrogen separation reaction.

In contrast, claim 16 recites that the products of an endothermic reaction are then simultaneously transferred to a secondary stage membrane reactor. Within the secondary stage membrane reactor the claimed process involves the simultaneous reaction to liberate additional hydrogen and the passing of hydrogen through a membrane to a purified hydrogen side. This simultaneous reaction and purification process of claim 16 is neither taught nor suggested by

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Holland. Holland teaches that the hydrogen separation portion of the process is merely passing previously liberated hydrogen through a membrane. At column 8, line 55 –column 9, line 6, Holland teaches that the hydrogen separating device is a hydrogen permeable membrane. Nowhere does Holland teach or suggest transferring the products of an endothermic reaction to a membrane reactor. Similarly, nowhere does Towler teach or suggest transferring the products of an endothermic reaction to a membrane reactor. As such, all elements of claim 16, or claims that depend therefrom, are neither taught nor suggested by Holland alone or in combination with Towler. In the absence of a teaching or suggestion of all elements of the process of claim 16, a *prima facie* case of obviousness is not satisfied.

Holland also teaches away from the claimed process. A prior art reference teaches away from a claimed invention if the cited prior art “criticize[s], discredit[s], or otherwise discourage[s] the solution claimed.” *In re Fulton*, 391 F.3d 1195 (Fed. Cir. 2004). Holland teaches that a membrane reactor is both unsuccessful and prohibitively expensive to operate. Holland teaches: “However, this approach [membrane reactor] has rarely been successful in practice. It greatly increases the complexity of design and also greatly increases the complexity of maintenance of the unit.” (Column 3, lines 43-45.) As such, Holland both criticizes and discredits the use of a secondary stage membrane reactor as per subject claim 16.

Surprisingly, and in the face of Holland’s teaching away, Applicant discovered that combining a first stage high temperature reforming reaction with a secondary stage membrane reactor as per claim 16 achieves “the simplicity and efficiency advantage of replacing the two water-gas shift reactors and hydrogen purifier by a single membrane reactor.” [0013] Thus, where the prior art teaches that the claimed solution is both unsuccessful and overly expensive,

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Applicant found unexpected advantages associated with the use of such a secondary stage membrane reactor.

Overall, claim 16 recites a process that is neither taught nor suggested by Holland or Towler alone or in combination. Moreover, the claimed solution is both discredited and discouraged by the cited prior art. In further support of the distinctions between the claimed process and that of Towler or Holland, Applicant hereby incorporates by reference the remarks made of record 4 May 2009.

With respect to the rejection of claim 28 as unpatentable over Towler in view of Holland and Thompson, no cited teaching of Thompson corrects the aforementioned deficiencies of the combination of Towler and Holland. Thus, claim 28 has an independent basis of patentability.

Applicant submits that pending claims 17-22, 24, 25, 27 and 28, each of which depend from claim 16, are allowable as dependent from claim 16 believed to be in allowable form and directed to patentable subject matter. In light of the above remarks, reconsideration and withdrawal of the rejection as to claims 16-22, 24, 25, 27 and 28 as unpatentable over Towler in view of Holland alone or in combination with Thompson is respectfully requested.

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Summary

Claims 16-22, 24, 25, 27 and 28 are pending in the application, of which only claim 16 is in independent form. Entry of this amendment and reconsideration and withdrawal of the rejection as to these claims and passing of this application to allowance are requested.

The Director is hereby authorized to charge any deficiency in the fees filed, asserted to be filed or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our Deposit Account No. 07-1180.

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Respectfully submitted,

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